

EM-RFO--KHLL-NONPUOPS1-2002-0002 FINAL

Non-Plutonium Operations Area I
(Name of Facility)

Balance-of-Plant
(Facility Function)

Rocky Flats Env. Technology Site Kaiser-Hill Company, L.L.C.
(Site) (Contractor)

Name: Jerry Anderson
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(Facility Manager/Designee)

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(Originator/Transmitter)

Name: S.L. Cunningham **Date:** 08/13/2002
(Authorized Classifier (AC))

1. Occurrence Report Number: EM-RFO--KHLL-NONPUOPS1-2002-0002

Beryllium Sample Results Above Action Level

2. Report Type and Date: FINAL

Date Time
Notification: 07/03/2002 13:37 (MTZ)
Initial Update: 08/15/2002 12:05 (MTZ)
Latest Update: 09/12/2002 10:21 (MTZ)
Final: 09/20/2002 15:24 (MTZ)

3. Occurrence Category: Off-Normal

4. Number of Occurrences: 1 **Original OR:**

5. Division or Project: Kaiser-Hill Company, L.L.C.

6. Secretarial Office: EM - Environmental Management

7. System, Bldg., or Equipment: Building 865

8. UCNI?: No

9. Plant Area: RISS

10. Date and Time Discovered: 07/02/2002 12:00 (MTZ)

11. Date and Time Categorized: 07/02/2002 13:34 (MTZ)

12. DOE HQ OC Notification:

Date	Time	Person Notified	Organization
NA	NA	NA	NA

13. Other Notifications:

Date	Time	Person Notified	Organization
07/02/2002	13:35 (MTZ)	Fac Rep, D. McCranie	DOE/RFFO

14. Subject or Title of Occurrence:

Beryllium Sample Results Above Action Level

15. Nature of Occurrence:

10) Cross-Category Items
C. Potential Concerns/Issues

16. Description of Occurrence:

On June 24, 2002, the Building 865 D&D subcontractor received beryllium sample results that indicated four individuals were exposed to airborne beryllium above the Action Level which is 0.2 micrograms per cubic meter (ug/m³) 8-hour time weighted average (TWA). The sample results ranged from 0.0017 to 29.18 ug/m³. All workers were in the required full-face respiratory protection.

On June 18, 2002, four Environmental Chemical Corporation (ECC) personnel (2 craft and 2 laborers) and a Radiological Control Technician (RCT) were assigned to D&D activities in Room 149. Each member of the crew wore a full set of anti-contamination clothing and full-face respirators fitted with HEPA cartridges and received a personal air sampling pump to monitor for potential beryllium exposure. While the crew was removing a 30-gallon drum located below and attached to a hopper at the southeast side of Room 149, the drum bumped the bottom of the spout below the hopper causing a small amount of dust to fall from the spout onto the top of the drum. At the time of the release, two of the crew were in the room with the remaining three standing outside the room at the door. The crew immediately stopped removing the drum, left the room, closed the door, and called for the assistance of the RCT. The RCT performed a contamination survey and found no residual radioactive materials on the crew member's

protective clothing. The crew then left the area. The ECC Air Monitoring Specialist (AMS) removed the individual's personal sample pumps and provided the filter cartridges to Kaiser-Hill for analysis. The results were received June 24, 2002.

17. Operating Conditions of Facility at Time of Occurrence:

Not Applicable

18. Activity Category:

11 - Facility Decontamination/Decommissioning

19. Immediate Actions Taken and Results:

The employees evacuated the area and sealed the room. The project suspended all work in the room until a corrective action plan could be implemented.

20. Direct Cause:

6) Management Problem
B. Work Organization/Planning Deficiency

21. Contributing Cause(s):

3) Personnel Error
C. Communication Problem

22. Root Cause:

6) Management Problem
B. Work Organization/Planning Deficiency

23. Description of Cause:

The direct and root cause of this occurrence was determined to be a deficiency in the work control planning. The work control document did not address contingency actions in the event of damage to hopper components or unexpected changes to work conditions. Secondary containment around the hopper or components was not used during the removal of the drums. The use of secondary containment around the hopper may have prevented or mitigated the release caused by bumping the hopper valve. The initial evaluation of the area indicated that the bags inside the drums were of sufficient integrity to contain the dusts or fines inside the drums. This proved to be an accurate assumption as no damage to the bags occurred during the activities on June 18, 2002. The actual release arose when the hopper valve was bumped while removing the drum.

Furthermore, the sequencing of work execution steps was inadequately planned and did not focus on minimizing the number of crew required to execute the work in order to maintain personnel exposures as low as reasonably practicable.

The contributing cause was determined to be inadequate communications. During the investigation, several members of the crew and ECC management expressed a concern relating to the lack of clear direction on the sequencing of work within Room 149. Specifically, the crew members held differing opinions as to the adequacy of the pre-job briefing held on June 18, 2002. Crew members' different assignments of tasks, as directed by the Superintendent, led to a lack of consensus for the team.

24. Evaluation (by Facility Manager/Designee):

Room 149 was located within Room 140 on the north end of Building 865. The house vacuum system is located within Room 149 and served the Maintenance Shop, Room 135, and the chemical hoods of Rooms 106, 107, 108, and 109. The system consisted of an air pump and two hoppers with drums fitted below each. The Historical Site Assessment for Building 865 indicates that beryllium fines may remain within the hoppers, the vacuum system lines, and the drums attached below each of the hoppers. Room 149 was physically isolated from Room 140 by constructed walls and ceiling. Two individual high efficiency air particulate (HEPA) units, separate from the house vacuum system, filter air entering the room. Exhaust from the room feeds into the main building exhaust system. The surface area of the room is less than 150 square feet.

ECC is tasked by Kaiser-Hill to perform the dismantlement, abatement, decontamination, and demolition of the Building 865 Complex. As part of this effort, ECC must remove the house vacuum system components, piping, and ventilation ducts, dismantle Room 149, and collapse the secondary containment system.

On June 10, 2002, the ECC AMS, the ECC Radiological Engineer (RE), the Kaiser-Hill Radiological Operations (Rad Ops) Foreman, and a Kaiser-Hill RCT entered the Building 865, Low Bay to perform characterization surveys of Room 149 to document contamination levels of radioactive materials and beryllium. The survey team conducted the activities under JHA-030, "Characterization of Room 149", and RWP-02-865-002, Rev. 0, "Be Surveys". The RCT obtained smears from the air pump, hoppers, piping, and floor of Room 149. A personal air monitoring device to monitor airborne beryllium exposure was assigned to the RCT as representative of the survey team. A radiological screening of the smears indicated no removable surface contamination. On June 13, 2002, ECC received the results of the beryllium smears and the personal air monitoring performed for the AMS. The personal air monitoring indicated airborne beryllium levels to be less than 0.020 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). The action level for beryllium exposure in air is 0.2 $\mu\text{g}/\text{m}^3$ over an 8-hour TWA as measured

in the workers breathing zone. The smears indicated the presence of beryllium surface contamination greater than 3 micrograms per 100 square centimeters ($\mu\text{g}/100\text{ cm}^2$). Surface contamination ranged from 11 $\mu\text{g}/100\text{ cm}^2$ from the inlet to the pump, to 0.65 $\mu\text{g}/100\text{ cm}^2$ from the floor near the doorway. The AMS and RE discussed the sampling results with a K-H Industrial Hygiene representative, as well as the proposed personnel monitoring for the dismantling work in Room 149.

On June 17, 2002, the ECC Superintendent and an ECC worker entered the containment structure to perform encapsulation of the interior of Room 149. The encapsulation is conducted using a non-toxic liquid encapsulant that is applied using an airless sprayer unit. When dry, the encapsulant adheres contamination and dust to surfaces that the materials are directly applied to or settles onto. Tasks were performed under JHA-008, "Encapsulation", and RWP 02-865-006, Rev. 0, "Building 865 Low Bay". The Forman and worker performed the encapsulation, each wearing a personal air sampling pump. ECC received the beryllium sampling results for the encapsulation activity on June 26, 2002. The results of the analysis of the samples indicated an 8-hour TWA of 0.007 $\mu\text{g}/\text{m}^3$.

On June 18, 2002, the ECC Superintendent held a pre-job briefing with the selected dismantlement crew. The work was to be performed under the approved Dismantlement Work Plan and the Procedure No. DIS-004, "Dismantlement of Stand-Alone Tanks". The Superintendent also briefed the crew to JHA-017, "General Dismantlement", and RWP 03-865-006, Rev. 0, "Building 865 Low Bay". The Superintendent discussed the general approach to executing the work, the tasks to be performed, and egress requirements in the event of unforeseen or unusual events. The Superintendent had also discussed with each crew member the specific tasks to be performed individually. The task included removing the debris scatter on the floor. The debris consisted of paper, used disposable coveralls, bolts, and trash. The crew was to place the lids on the three drums located in the room, remove the drums from the two hoppers, and finally, proceed with the removal of the house vacuum system components. The removal of the vacuum system components included removing the drums from below the two hoppers, dismantling and removing the vacuum lines associated with the two hoppers and vacuum pump, and physically removing the two hoppers and vacuum pump.

Four ECC personnel (2 craft and 2 laborers) and an RCT were assigned to the crew. The RCT provided periodic monitoring for potential radiological exposures. No more than four individuals worked in the room at any time during the work performed in Room 149. Each member of the crew wore a full set of anti-contamination clothing and full-face respirators fitted with HEPA cartridges. Each member of the crew received a personal air sampling pump to monitor for potential beryllium exposure.

The crew first placed debris scattered around the floor of the room into an empty 20-gallon drum left in the room by previous building occupants. The empty 20-gallon drum was located on the floor between the two hoppers, on the south side of the room. The crew then sealed the 20-gallon drum, placed the drum into a plastic bag, taped the bag shut, and removed the bagged 20-gallon drum from the room. The crew then proceeded to remove a 30-gallon drum located below and attached to the hopper on the southwest side of the room. The drum contained a plastic bag sleeved and attached to a spout below a valve on the bottom of the hopper. A craft person carefully closed the valve feeding into the spout to which the bag was attached. The craft person then removed the bag from around the spout, and taped the bag closed. The drum lid was then placed onto the drum. The same person then checked the valve to make sure that it was tightly closed. The drum was removed from beneath the hopper and placed to the left of the hopper.

The crew then proceeded to repeat the process on the hopper located on the southeast side of Room 149. Each task was performed the same. However, the drum located below the second hopper had adhered to the floor of the room because of the encapsulant applied the previous day. The person removing the drum applied force to release it from the floor. The force removed the drum, causing it to bump the bottom of the spout located below the hopper. The bump to the spout caused a small amount of dust to fall from the spout onto the top of the drum. At the time of the release, two of the crew were in the room, the remaining three standing outside the room at the door. The crew immediately stopped removing the drum, left the room, closed the door, and called for the assistance of the RCT. The RCT performed a contamination survey and found no residual radioactive materials on the crew member's personal protective clothing. The crew then left the beryllium regulated area.

The ECC AMS removed the individuals' personal sample pumps and provided the filter cartridges to Kaiser-Hill for priority, rush analysis. On June 24, 2002, ECC received the beryllium sampling results that indicated 8-hour TWAs ranging from 0.0017 to 29.18 ug/m³ for the five individuals. Industrial Hygiene performed a personnel beryllium exposure calculation and determined that although the worker with the highest air sample result was in an environment where airborne concentrations exceeded the Permissible Exposure Limit (PEL) and Short Term Exposure Limit (STEL), he did not exceed the PEL or STEL "in-mask" limits. This is based on an analysis of the event and the fact that he was in an Air Purifying Respirator (APR) with a Protection Factor (PF) of 50 minimum and was therefore adequately protected.

Since the incident, Kaiser-Hill prohibited entry into Room 149 pending performance of causal analysis and implementation of corrective actions. The hoppers, vacuum pump, piping, ventilation, and one drum remain in Room 149.

25. Is Further Evaluation Required?: No

26. Corrective Actions (* = Date added/revised since final report was approved.)

1. Prepare Causal Analysis and propose additional actions as necessary for the identified high hazard work.

Responsibility: Keith Anderson

Target Completion Date: 07/29/2002 **Completion Date:** 07/29/2002

2. Prepare Task Specific Standard Operating Procedure (SOP) according to the approved Dismantlement Work Plan. Development of Task Specific SOP must include ECC Management, H&S Team Representative, and Crew, through walk-downs and application of lessons learned.

Responsibility: Keith Anderson/James Sinclair

Target Completion Date: 07/30/2002 **Completion Date:** 07/30/2002

3. Prepare Task Specific JHA identifying the steps to be performed, inventory of identified hazards, and controls to mitigate hazards.

Responsibility: Keith Anderson

Target Completion Date: 07/30/2002 **Completion Date:** 07/30/2002

4. Submit Task Specific JHA to K-H/DOE roundtable for review and concurrence prior to submitting to K-H Senior Review Board.

Responsibility: Keith Anderson

Target Completion Date: 07/31/2002 **Completion Date:** 07/31/2002

5. Revise JHA and Task Specific Standard Operating Procedure (SOP) according to comments received by K-H/DOE roundtable.

Responsibility: Keith Anderson

Target Completion Date: 08/05/2002 **Completion Date:** 08/05/2002

6. Conduct K-H Senior Review Board for ECC work team to verify ECC readiness to re-enter Room 149. Include beryllium Subject Matter Experts on the board.

Responsibility: Duke Snyder

Target Completion Date: 08/08/2002 **Completion Date:** 08/08/2002

27. Impact on Environment, Safety and Health:

There is no impact on the health and safety of the workers, the public, the environment, quality or security as a result of this occurrence. Each member of the crew wore a full set of anti-contamination clothing and full-face respirators fitted with HEPA cartridges. Each member of the crew received a personal air sampling pump to monitor for potential beryllium exposure. Since this personnel

protective equipment was being worn, personnel working in the area were adequately protected from beryllium exposure.

28. Programmatic Impact:

D&D activities in Room 145 were suspended for a significant period of time in order to implement the corrective actions identified in this report, including ECC's actions for high hazard work. First, a concise sequencing of work execution steps must be planned and evaluated by ECC management, the crew, and K-H oversight. The planning must focus on minimizing the number of crew required to execute the work and maintain personnel exposures as low as reasonably practicable. Next, the use of and techniques for secondary containment around the hoppers, hopper components, and the vacuum unit must be included into the selected work control document. Finally, contingency actions that address unexpected or changes to work conditions must be included into the selected work control document.

29. Impact on Codes and Standards:

There is no impact to codes and standards as a result of this occurrence.

30. Lessons Learned:

During the performance of D&D work in some buildings, facility workers are likely to uncover highly contaminated areas. It is important that as these areas of higher contamination are identified, work is properly planned to afford the workers the highest level of protection necessary. First, a concise sequencing of work execution steps must be planned and evaluated by management, the crew, and oversight personnel. This planning must focus on minimizing the number of crew required to execute the work and maintain personnel exposures as low as reasonably practicable. Next, the use of and techniques for secondary containment, if necessary, must be included into the selected work control document. Finally, contingency actions that address unexpected or changes to work conditions must be included into the selected work control document.

31. Similar Occurrence Report Numbers:

RFO--KHLL-PUFAB-2001-0065 RFO--KHLL-SOLIDWST-2001-0063

32. User-defined Field #1:

020313 ISM=GP1-CF1

33. User-defined Field #2:

34. HQ Keyword(s):

01A--Conduct of Operations - Conduct of Operations (Misc.) 01V--Conduct of Operations - Inadequate Job Planning Other (Start Feb 99) 08D--OSHA/Industrial Hygiene Issues - Industrial Hygiene Exposure

35. HQ Summary:

36. DOE Facility Representative Input:

This is a very complicated issue. From a strictly technical stand, KH Industrial Hygiene calculations, using the OSHA PEL and the OSHA STEL, are correct. However, if one uses the ACGIH STEL of 10ug/m3 instead of 25ug/m3 they did exceed the 15 minute STEL. And, if one looks at the intent of the Rule (10 CFR 850), DOE is staying with the 2.0ug/m3 for the PEL; however, they state: "there is a body of evidence suggesting that the OSHA PEL (and the DOE PEL) does not adequately protect worker health. Therefore, DOE decided that a lower action level is appropriate for DOE facilities." This implies that they do not want the breathing air concentration to exceed 0.2ug/m3, thus 0.2ug/m3 would be used in place of the 2.0ug/m3 in the equation and this puts them over the acceptable breathing air concentration using the APR and would require PAPR for proper protection. DOE Industrial Hygiene feels this way after reading the language of 10 CFR 850 and the Preamble to the Rule.

Entered by: MCCRANIE, DEANNA C Date: 09/20/2002

37. DOE Program Manager Input:

38. Approvals:

Approved by: Jerry Anderson, Facility Manager/Designee
Date: 09/12/2002
Telephone No.: (303) 966-6438

Approved by: MCCRANIE, DEANNA C, Facility Representative/Designee
Date: 09/20/2002
Telephone No.:

Approved by: Approval delegated to FR, Program Manager/Designee
Date: 09/20/2002
Telephone No.: